Williams AFB
ST12 Fuels Spill Site
Informal Dispute

10/17/17

ST12 Fuels Spill Site Dispute Overview

- Former Fuel Storage Area (above and below ground leaking USTs); contamination extends below water table to 230' depth.
- Original Pump and Treat remedy failed, 1st RODA selected SVE to treat vadose zone only, SVE remedy is still in progress.
- 2013 2nd RODA selected Steam Enhanced Extraction followed by Enhanced Bioremediation (EBR) to treat contamination below water table.
- The $20 million dollar SEE terminated and dismantled over agency objections in April of 2016 as thousands of lbs. of hydrocarbons were still being removed daily.
- Workplan specified performance criteria for terminating SEE had not been met.
- Informal dispute invoked on July 28, 2016 over SEE termination; evolved into a dispute over inadequacy of workplan to implement EBR.

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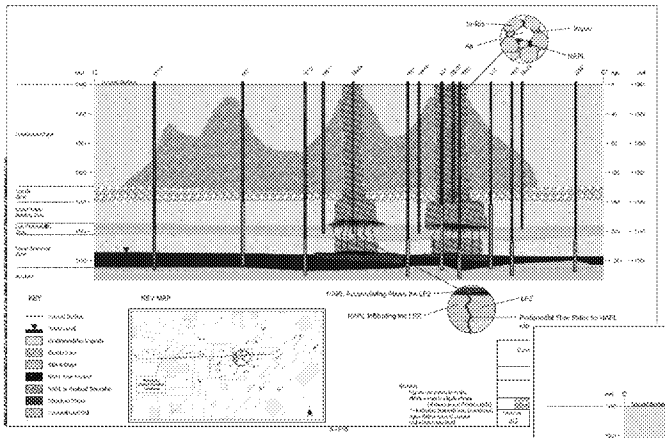
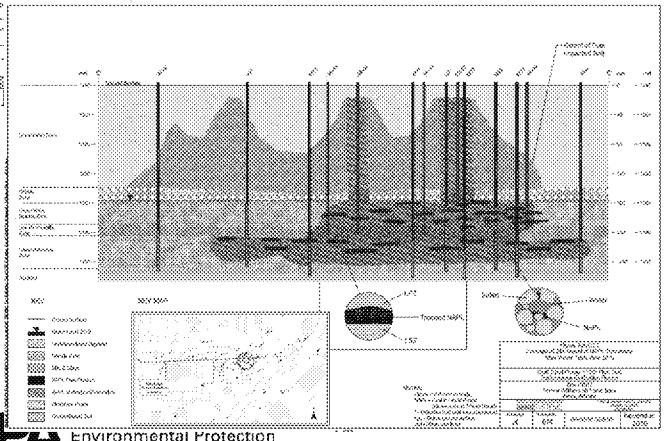
Conceptual Site Model



Fuel release extends to 230' depth to previous maximum lowest water table due to agricultural over pumping



Smear zone of contamination across 3 hydrologic units as water table has risen 80 feet since conversion to metropolitan land use

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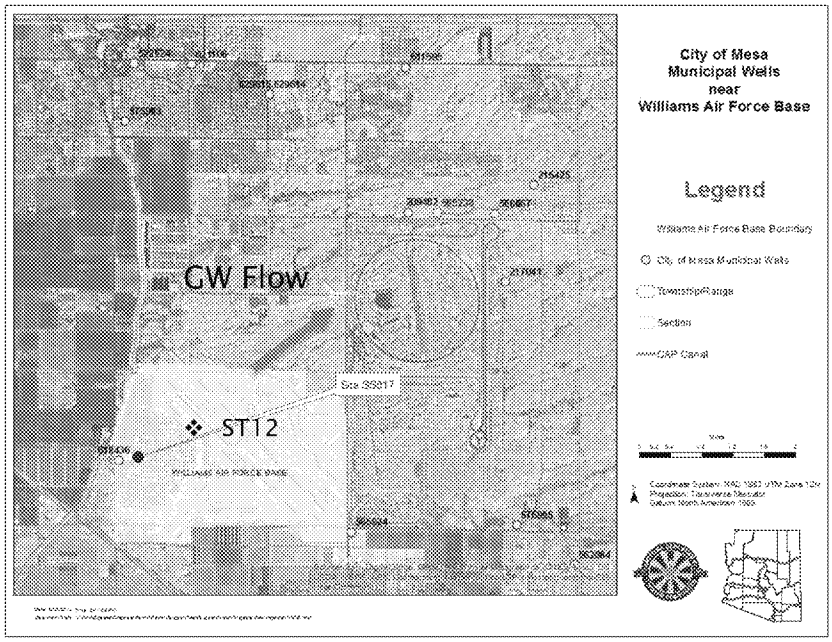
This would be the 2nd formal dispute for ST12

- First formal dispute invoked in 2005 following AF termination of funding for operation Thermal Enhanced Extraction (TEE) Pilot test after it had been constructed and subsequently dismantled.
- Dispute was resolved in 2006 just as it was being elevated to RA level, following AF meeting in Senator McCain's office.
- TEE Pilot was refunded and reconstructed; operated between 2008 -2009, removing 117,902 lbs. / 18,540 gallons. Considered a success, led to full scale implementation under PBR contract.

Current site status:

- Current estimates of mass remaining after SEE range from 1.1 to 6.3 million lbs. (SEE removed 2.6 million lbs.)
- AF is proposing to use EBR with sulfate injection to remediate potentially twice as much mass as was removed with SEE. Original intent of the remedy was for EBR to be a polishing step to degrade remaining dissolved phase after SEE removed the bulk of LNAPL
- 2013 RODA2 specified a timeframe of 20 years to achieve RAOs.
- AF has acknowledged that the model relied upon in their Addendum 2 RDRA Workplan for EBR is "not predictive" for estimating time of remediation (TOR)
- EPA/ADEQ team prepared independent TOR estimate based upon current mass estimates under EBR ranging from 100-200 years; still exceeding the 50- 100 year timeframe discussed in the 2005 dispute
- PFAS fire fighting foams were also released at the site and allowed to infiltrate soils, but has not yet been assessed, impact on remedy is unknown.

Downgradient future receptors



- New Eastmark planned residential commercial, industrial area with, schools, hospitals just east of Williams
- City or Mesa has 5 wells planned with pumping rates of 1000 gpm each, first installed in March 2017; 3 more drilled, will start pumping next year

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Overarching Dispute Issues

- Criteria for termination for SEE specified in the workplan not met; If we cannot hold them to their original workplan, how can we hold AF accountable to what is written in their future workplans?
- EBR workplan as proposed does not have specific decision criteria for evaluating remedy success or failure; lacks adequate initial characterization and adequate monitoring to evaluate the remedy going forward
- EBR has not been adequately pilot tested; has not even been demonstrated that microbial population to be enhanced is present following thermal treatment.
- Proposed EBR implementation does not provide containment of contaminants and will allow injected sulfate to migrate off site, does not even ensure that injected sulfate will reach the targeted areas for treatment.
- 2013 RODA2 could be reinterpreted to allow AF 20 year MNA period to demonstrate success or failure of EBR once it is implemented, despite high improbability of achieving RAOs within that timeframe.

Workplan Criteria for SEE EBR transition not met:

- No timeframe specified for operations, but SEE was terminated after 18 months of operation. Electrical usage at the time was 53% of budget.
- The criterion for mass removal of < 10 % of peak recovery rate was not attained as vapor recovery alone was about 25 % of peak recovery rate with 3000 pounds/day recovered in vapor along with thousands of gallons of LNAPL.
- Total steam injection was at 94% of the design for the project, representing less than the projected 1.6 pore volume of flushing originally planned (with at least 2 pore volumes being ideal.)
- Remaining groundwater benzene concentrations in the SEE wells were as high as 7,400 micrograms per liter (ug/l), greatly exceeding the 100-500 ug/l specified as transition criterion in the workplan for EBR to meet the 20 year timeframe specified in the RODA 2.

Problems with Addendum 2 RDRAWP for EBR

- To avoid formal dispute, the agencies agreed to allow EBR to proceed provided that identified deficiencies could be resolved.
- The agencies technical team prepared a checklist of DQOs to incorporate into the EBR monitoring program, but the July 2017 Addendum 2 RDRAWP only partially addressed some of them.
- Letter sent on 9/22/17 outlining deficiencies and requesting technical meeting to discuss.
- We expect AF's response during 10/17 BCT meeting
- Formal dispute statement is prepared and ready to file

Minimum requirements for acceptance of Addendum 2 RDRAWP for EBR (from 9/22/17 letter)

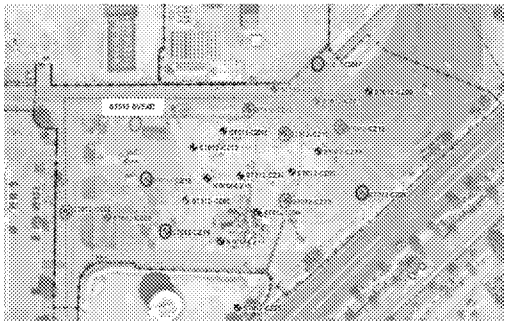
1. **Characterization**: Site must be adequately characterized across the site in each of 3 depth zones, including extent of Benzene, LNAPL and COC content of the LNAPL as well as post SEE biological and geochemical conditions to document baseline conditions for future monitoring.

2. **Predictive Modeling with Decision Criteria:** AF must demonstrate through predictive modeling and field tests that RAOs can be achieved within the timeframe specified in the ROD, provide TOR estimates for each of the 3 depth zones, and appropriate decision criteria must be developed to be able to determine within a few years if the remedy is proceeding as expected to achieve RAOs.

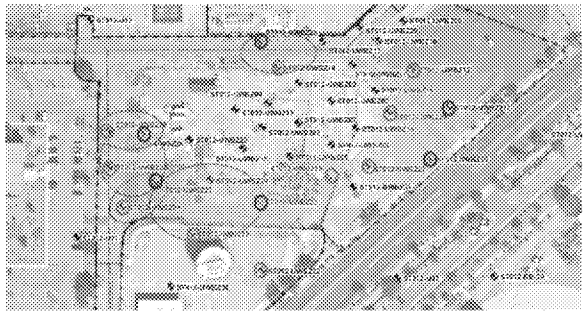
3. **Robust Monitoring Plan**: Develop a monitoring program using the checklist guidelines provided by the Agencies. Because AF rejected the option of doing a pilot test, each of the 32 treatment ovals from the May 2017 BCT meeting need at least 1 monitoring well to be able to evaluate (see next slide)

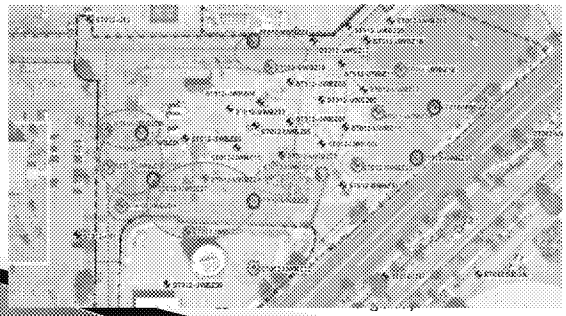
In many instances proposed extraction wells (shown in blue) are upgradient or side gradient of proposed injection wells (shown in green) with distances over 70 feet and no monitoring wells in between. Interpretation will be subject to many assumptions which may not be valid or accurate.

Cobble Zone (CZ)



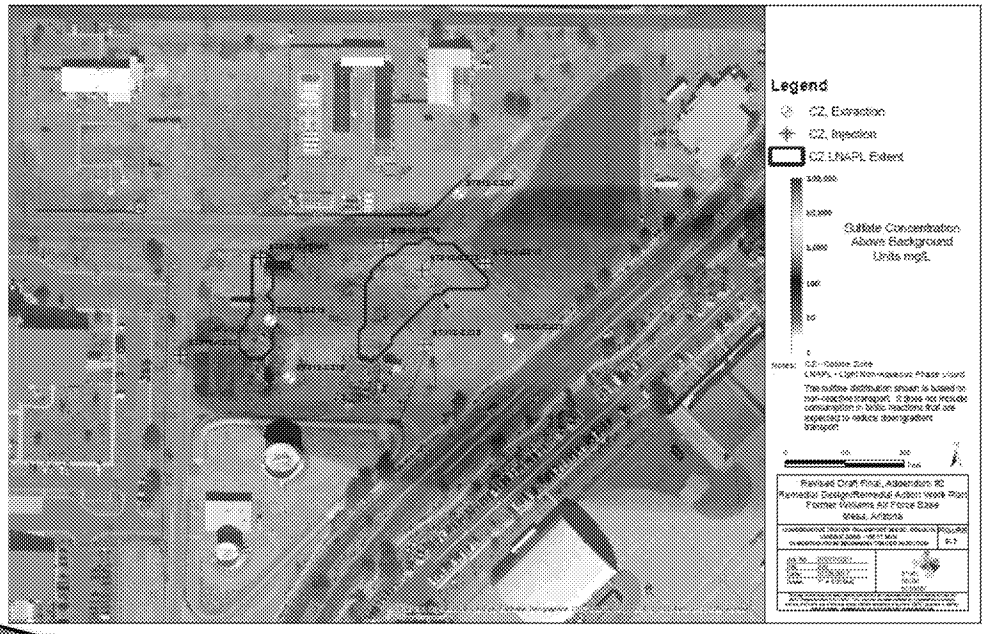
Upper Water Bearing Zone (UWBZ)





Lower Saturated Zone (LSZ)

- Must provide containment for long term protectiveness; current plan allows injected sulfate amendment to migrate off site and degrade downgradient resources. Targeted treatment areas may not even be reached.



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Options to resolve dispute

1. Incorporate the agencies DQO requirements into the RDRAWP2 for full scale EBR implementation.
2. Propose a scaled back pilot test of EBR incorporating the DQO requirements at reduced cost.
3. Instead of sulfate injection, implement extraction for containment and to draw upgradient ambient sulfate into the treatment area to begin degrading contaminants.
4. Perform additional SEE to remove the bulk of remaining mass until benzene concentrations meet the criteria specified in the original RDRA Workplan.
5. Elevate to formal dispute.